

5. On the Structure of a new Species of Earthworm of the genus *Benhamia*. By FRANK E. BEDDARD, M.A., F.R.S., &c.

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Two specimens of a species of *Benhamia* have been kindly placed in my hands by Mr. Budgett, of Trinity College, Cambridge. They were collected by him on McCarthy Island on the Gambia, and prove to be in an excellent state of preservation for anatomical purposes. I believe them to be referable to a new species, of which I propose to associate the name with that of Mr. Budgett. The following is a description of *Benhamia budgetti*:—

*External characters.*

The length of one individual (the two were fairly equal in size) was 116 mm., by 5 or 6 mm. in breadth.

The *buccal lobe* cannot be described with accuracy as it was almost entirely withdrawn into the buccal cavity. In correspondence perhaps with this withdrawal, the first segment of the body was deeply grooved dorsally and before backwards.

The setæ, as usual, are closely paired. All the four pairs are about equidistant, and the area occupied by them collectively is about  $\frac{1}{3}$  of the circumference of the body. They do not appear to be wanting upon any of the segments of the clitellum except the ventral pair upon the xviiith and xixth segments, where they are of course replaced by the penial setæ, and, I think, the corresponding pair upon the xviiiith segment. These setæ are generally, but not always, absent in *Benhamia*.

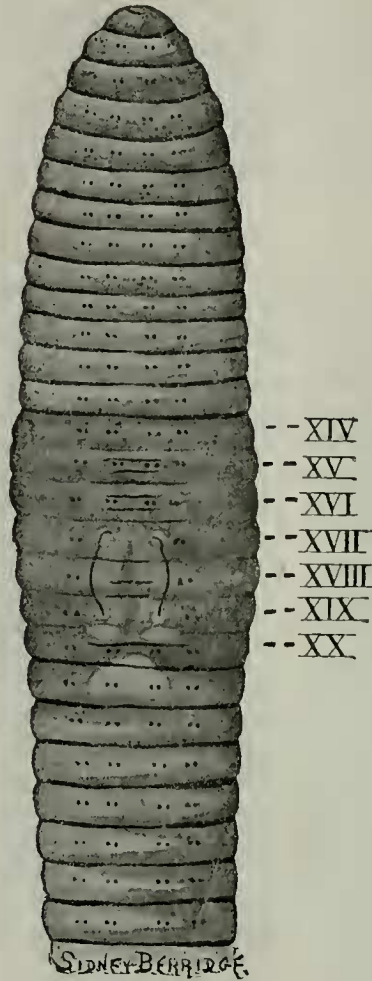
The *clitellum* occupies entirely segments xiv.–xx. inclusive, and also, at least in one specimen, the latter half of segment xiii. It is incomplete along a narrow ventral line which corresponds to the area occupied by the ventral pairs of setæ and their interspace. This area forms almost a gutter owing to the bulging of the integument along each side, which however does not commence until the xvth segment.

*Dorsal pores* are present, and are especially conspicuous at the tail end of the body.

The *genital papillæ* of this species are not numerous. There are a pair upon segment xx. which extend on to xix., and are in line with the orifices of the spermiducal glands. A median papilla lies upon the end of segment xx., whose area is rather less than that of the two anterior papillæ and their interspace. This papilla was only obvious in one specimen. Finally there is a larger median papilla upon the twenty-second segment, whose area extends beyond the ventral setæ. It is hardly to be separated from the papilla in front. These papillæ are all conspicuous from their white colour.

The *orifices of the oviducts* appear to be upon the fourteenth segment. On this segment and between the ventral setæ is a small convex quadrangular area with rounded angles. I believe that the actual pores are placed at the sides of this convexity in the valley which separates it from the surrounding integument, but I have not seen them.

Fig. 1.



Ventral surface of *Benhamia budgetti*. The clitellar segments are numbered.

The *orifices of the spermiducal glands* are upon the xviiith and xixth segments. The usual furrow connects the two pores of each side. This furrow is on both sides bowed outwards; it passes outside of the position of the ventral setæ of the xviiith segment; but the setæ themselves I have not succeeded in seeing, nor the apertures of the sperm-duct.

*Structure of the body-wall.*—Very few examples of this genus

have been examined microscopically; our knowledge of the more minute structure of the genus is indeed limited to that of the smaller forms. I have investigated the structure of the body-wall in the present species, which shows certain features worthy of note.

The first point to which I direct attention is the vascularity of the epidermis. This structural peculiarity occurs, but is not common, among earthworms. I was myself the first to announce that certain *Oligochæta* resemble the Leeches (in which group the fact had been previously ascertained by Lankester) in having a vascular epidermis.<sup>1</sup> This character, however, has not been found in many earthworms. It seems to me therefore to be worth recording the fact that the *Benhamia* which forms the subject of the present communication has a vascular epidermis. It appeared to me moreover to be more abundantly vascular than I have observed to be the case elsewhere. The capillaries are very readily seen owing to their being injected with their own blood; they penetrate the actual epidermis as loops which reach perhaps halfway through the thickness of the epidermic layer. I could find no trace of their opening on to the exterior, which has been asserted by the Messrs. Sarasin in the case of *Perichæta*.

It is also to be noted that in the anterior region of the body, at any rate in the neighbourhood of the spermathecæ, intra-epidermic capillaries are so rare as to be practically absent. I only saw one or two loops in a large number of sections. They can be of but little functional importance in this part of the body; but they are clearly of great functional importance towards the hinder end of the body. As a matter of fact these capillaries do not apparently penetrate the epidermis at the very end of the body; but this may conceivably be due to fresh growth in this region. That the epidermis should be especially vascular posteriorly is interesting when we reflect that it is in this situation that gills are chiefly developed in branchiate *Oligochæta*.

A second point of interest concerning the body-wall of this species is that the longitudinal muscles have the bipinnate arrangement, first described by Claparède in *Lumbricus*, but not by any means universal among earthworms.

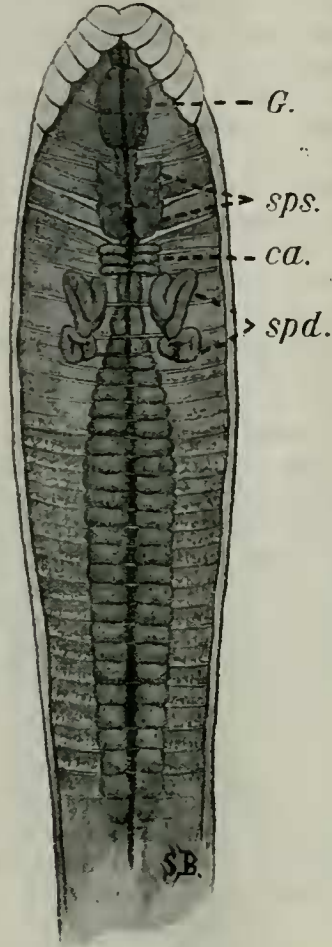
#### *Internal Structure.*

The accompanying drawing (fig. 2, p. 656) illustrates a general view of the internal viscera, and expresses at the same time some of the specific peculiarities of the species. The anterior portion of the two gizzards (which completely hide the underlying spermathecæ) is to be noticed. The position of the calciferous glands (*ca*), the last pair of which are situated in the xvith segment, is important; and also the fact that the large intestine may be said to commence in the xxist segment, as it does not attain to its greatest

<sup>1</sup> "On the Anatomy and Histology of *Pleurochæta moselcyi*," Trans. Roy. Soc. Edinb. 1880, and "On the Structure of the Body-wall in certain Earthworms," Proc. Roy. Phys. Soc. Edinb. 1881.

width until that segment. The difference in size between the anterior and posterior pairs of the spermiducal glands is clear (*spd.*). The sperm-sacs (*sps.*) are to be seen in the xith and xiith segments, a quite usual place for them.

Fig. 2.

General dissection of *Benhamia budgetti*.

*G.*, gizzard; *sps.*, sperm-sacs; *ca.*, calciferous glands; *spd.*, spermiducal glands.

The *intersegmental septa* of this worm have the following arrangement:—

The first septum, which is fairly thick, marks the anterior end of the anterior gizzard; the next, also thick, the posterior end; then follows an excessively thin one. Another thin septum marks the posterior boundary of the second gizzard. After this are four closely crowded and also fairly thick septa. The two next, which lie on the posterior boundaries of the xith and xiith segments, are



also thickened. The next septum is thin and delicate, but curved forwards like those in front. After this the septa are all thin but run straight across the body-cavity. A few strands of muscle bind together some of the thickened septa, but they are not very strongly marked.

The *alimentary canal* is, as in other *Benhamiæ*, furnished with two *gizzards*. The last of these undoubtedly lies in the sixth segment. The first appears to occupy the fourth segment, two septa intervening between the two gizzards. The gizzards, which are very stout, are pushed back and really overlie and absolutely conceal the spermathecæ. Hence the crowding of the septa which immediately follow them. There seems in fact to be more independence between the position of the septa and the intersegmental furrows than is usually the case. The *calciferous glands* lie in a position which they do not invariably occupy in this genus, *i. e.* in segments xiv., xv., xvi. They are of a bronzy yellow colour. The *intestine* does not assume its greatest width until segment xxi. I could find no intestinal cæca such as are sometimes present in the species of this genus. There is a typhlosole in the anterior part of the gut but not posteriorly.

Besides a difference in position, that is to say of the segments occupied by these glands, the calciferous pouches differ in certain other points of structure among the species of this large genus. In the present species the surface of the glands is fairly smooth; the furrowing, seen to so marked a degree for example in *Benhamia cæcifera*, being practically absent. In transverse sections of the glands they are seen to be somewhat bean-shaped, with a hilum where the duct leaves the gland. On the opposite side there is but one distinct furrow not far from the lower end of the gland, *i. e.* that side which is nearest to the œsophagus. The three glands open into the œsophagus by only a single duct on each side. This duct is of considerable calibre, and is ciliated like the œsophagus; it has also muscular walls and is formed of three branches, one from each gland. The glands lie dorsally to the œsophagus for the greater part.

The *nephridia* of all species of *Benhamia* are of the "diffuse," "plectonephric," or "micronephric" type. Very generally in the description of species this statement has been made without any further additions. In others (as for instance *B. octonephra*) the more exact arrangement of the nephridial tufts has been noted and has afforded systematic characters. In the present species, there are 10 or 12 nephridial tufts on either side of the nerve-cord, which are rather more conspicuous from the 27th segment or so backwards than they are anteriorly. This is often the case with earthworms, and seems to be due to the peritoneal covering. The micronephridia of this species have a curiously squarish outline.

As to the *vascular system*, I have only to observe that the dorsal vessel is single throughout its course and that the last pair of hearts are in segment xiii.

*Reproductive Organs.* The sperm-sacs are large and rather

racemose in form; they lie in segments xi. and xii. I am inclined to think that delicate sacs involve the funnels of the sperm-ducts which are situated in segments x., xi. I detected the ovaries, attached as usual to the anterior wall of segment xiii.

The spermiducal glands are limited to their respective segments (*i. e.* xvii. and xix.) by being coiled. They are stout but not long; the muscular duct is also short and is about one fifth of the length of the gland. The posterior pair of spermiducal glands are distinctly smaller than the anterior pair. The structure of the penial setæ is shown in the accompanying drawing (fig. 3).

Fig. 3.



Penial seta of *Benhamia budgetti* greatly magnified.

There are the usual two pairs of *spermathecae*, which are completely hidden by the gizzards, and affect therefore to lie in a much more anterior position than is really the case. Viewed from above after removal of the gizzards, the four spermathecae are seen to be closely pressed together in the middle line, all of them in fact

touching. The posterior are elongated and quite twice the size of the anterior pair. They thus exactly match the spermiducal glands. On a dissection no diverticula are visible; but in longitudinal sections it is plain that a considerable number of tubular diverticula open into the duct part of the spermatheca which are enclosed within the same sheath. The arrangement in fact is very like that of *Benhamia beddardi* as figured by Horst<sup>1</sup>, only that the region occupied by the diverticula is relatively shorter.

From the account of the anatomy given above, the following definition of the species has been compiled:—

*BENHAMIA BUDGETTI*, n. sp.

Length 116 mm. × 5 or 6 mm. diameter. Clitellum xiii.–xx. Genital papillæ paired on xx., unpaired and median on xxi., xxii. Dorsal pores present. Furrows uniting spermiducal gland-pores convex outwards, passing to outside of ventral setæ of xviii. (which are absent?). Gizzards in v. and vi.; calciferous glands in xiv.–xvi.; large intestine begins in xxi., and has a typhlosole for part of its course. Spermathecae globular, with short duct and no external diverticulum; anterior pair smaller. Spermiducal glands not long, stout and coiled; posterior pair shorter. Penial setæ small, with spinelets on anterior fourth.

*Hab.* McCarthy Island, Gambia.

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June 19, 1900.

Prof. G. B. HOWES, LL.D., F.R.S., Vice-President, in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of May 1900:—

The registered additions to the Society's Menagerie during the month of May 1900 were 330 in number. Of these 38 were acquired by presentation and 56 by purchase, 16 were born in the Gardens, and 220 were received on deposit. The total number of departures during the same period, by death and removals, was 151.

Among the additions attention may be specially called to:—

1. A young female Cape Hunting-dog (*Lycan pictus*), obtained by purchase on May 4th. This is a rather rare and delicate canine animal, the present specimen of which seems likely to do well.

2. An Allen's Porphyrio (*Hydrornia alleni*), captured at sea and presented by Capt. J. C. Robinson, of the mail steam-ship 'Kildonan Castle,' on May 15th, who kindly sends me the following note on the subject:—

"On the 1st of May, when the ship was in 8° South latitude and

<sup>1</sup> Notes Leyd. Mus. xvii. pl. i. fig. 6.